

BIM and Heritage Conservation

Goals of Presentation:

- ❖ Introduction to what BIM is.
- ❖ Software used for BIM.
- ❖ Benefits and challenges of BIM.
- ❖ Measuring for BIM.
- ❖ What can the Heritage Conservation field bring to BIM?
- ❖ What can BIM bring to the Heritage Conservation field?
- ❖ Public interaction.

BIM is a tool with a future in Heritage Conservation.



Images: 3D studies for façade restoration.
RMA.

Definition of BIM – official definition and generally understood

“Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to **demolition.**” *From Canada BIM Council website:*
<http://www.canbim.com/about-canbim-0/faq-1>”

* The definition indicates a life-cycle ending in **demolition.** There is a need to educate the BIM institutions that heritage conservation does not consider demolition as part of the life cycle.

A commonly understood definition is creating a building in 3D only, not thinking beyond the use of 3D in the design and construction phase. This was the approach used in the Library of Parliament rehabilitation project started in 1998, where a 3D software, CATIA was used to draw up the Library and its primary building assemblies to aid in understanding the building and for preparation of construction documents.

Where a picture is worth a thousand words a 3D model is worth a million words (or more).

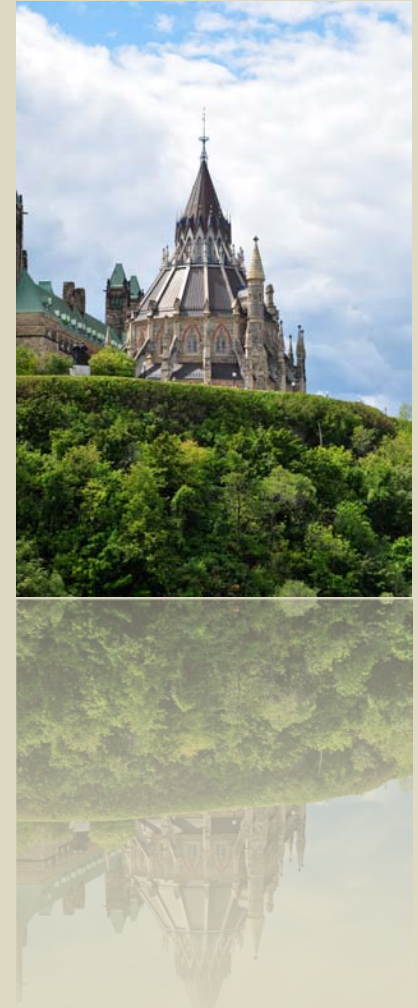


Photo: Library of Parliament. J. Maddigan

Software Used for 3D Modeling:

While software for 3D engineering has been used in the aerospace industry, it had not been used in the Architecture and Engineering (A&E) field due to cost and complexity. Gradually with advances in software and hardware technology, this changed in the 1990s.

Some of the software applications used today include:

- ❖ Graphisoft ArchiCAD. (<http://www.graphisoft.com/>)
- ❖ CATIA (<http://www.3ds.com/products/catia/>)
- ❖ Bentley MicroStation (<http://www.bentley.com/en-US/Products/MicroStation/>)
- ❖ Autodesk Revit (<http://usa.autodesk.com/revit/architectural-design-software/>)
- ❖ Google Sketchup/Building Maker
(<http://www.sketchup.com/3dwh/buildingmaker.html>)

Graphisoft appears to have been the first initiator of a purpose made 3D BIM software for A&E purposes in 1997.



3D model: Study for adaptation.
RMA

Benefits of generating heritage buildings in 3D BIM:

- ❖ Remote reviewing of the building interior and exterior.
- ❖ Allows study with new construction in context of environment.
- ❖ Allows study of different periods of time.
- ❖ Better appreciation of the building over using photographs to understand form, massing and texture.
- ❖ Allows evaluation of adaptations and renovations prior to committing to a strategy and full construction documents. For example, on the Library of Parliament project, the building was modeled up in different configurations to illustrate three proposed options for the restoration.
- ❖ Most people can understand a 3D building over one shown in 2D flat drawings.



Photo/Sketch: Study for restoration.
RMA

Challenges of creating a building in 3D:

- ❖ Accuracy of the survey.
- ❖ Time to do the survey.
- ❖ Increased Costs to project.
- ❖ Access Issues to do recording.
- ❖ Possible file and computer platform compatibility issues.
- ❖ Need to draw up each unique assembly and part such as walls, structure, windows, doors, etc. BIM for new buildings takes advantage of available libraries of contemporary building parts and assemblies that are readily available in online 3D libraries and/or built into the software.



Photo: Heritage window in St.John's, NL. J. Maddigan

Methods to Obtain Site Measurements to Draw BIM Building:

The heritage conservation field has a long history of recording and measuring buildings. There are the older techniques of measuring that take time and newer techniques that make data acquisition quicker and more accurate.

These include:

- ❖ Hand measuring, survey equipment, and photogrammetry. (Old)
- ❖ Laser Scanning. (Total Station; Creaform, Leica Scanstation...) (Newer)
- ❖ 3D Modeling based on using photos run through a software to generate 3D models. (Newest).

Some software for 3D modeling based on photos:

- ❖ PhotoModeler (<http://www.photomodeler.com/>).
- ❖ AutoDESK 1234 Catch (<http://www.123dapp.com/catch>).
- ❖ Strata Foto 3D (http://www.strata.com/products/strata_3d_cx_suite/strata_foto_3d_cx/);
- ❖ 3DSOM: <http://www.3dsom.com/> Increased Costs to project.



Photo: Laser scanning. *Wikipedia, Västgöten,*



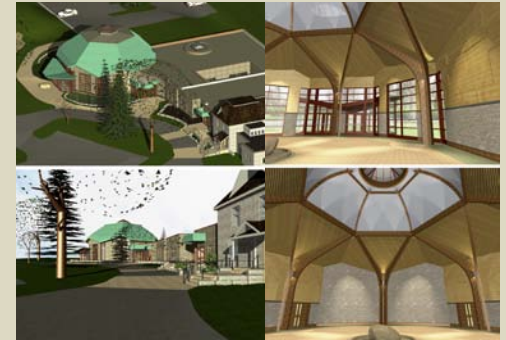
Photo: Photo recording. *J. Maddigan*

Examples of projects using BIM:

RMA uses Graphisoft on many of its projects including two significant heritage projects:

- ❖ Beechwood Cemetery, National Historic Site in Ottawa, to design the addition to the main facility to house the National Memorial Centre in support of its role as the National Military Cemetery in Canada.
- ❖ Dome Building, at Rideau Hall, National Historic Site, which saw the renovation and adaptation of the c. 1875 gasometer to barrier free accessible offices.

For these two projects the 3D modeling went beyond the design stage to being used during construction to guide the contractor and subcontractors in the construction of the buildings. Neither project, took BIM to the next stage of using it for maintenance, but the models will be available for future use and adaptation.



Images: 3D model for Beechwood. RMA.



Images: 3D structure model and actual structure for Beechwood. RMA.



Photos : Built conditions. Beechwood.
J. Maddigan / RMA.

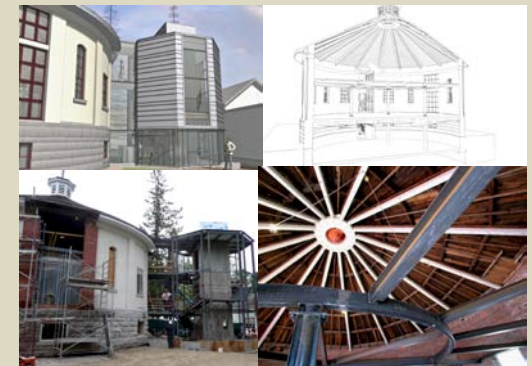
What can the Heritage Conservation field bring to BIM?

- ❖ Understanding of heritage buildings.
- ❖ Understanding context.
- ❖ Knowledge of materials and construction techniques.
- ❖ Knowledge of building pathologies (why and how buildings deteriorate).
- ❖ Repair methods and conservation.
- ❖ Understanding that the lifecycle for heritage buildings is not meant to end with demolition.
- ❖ Understanding that heritage buildings contain a wide range of materials and assemblies that are not documented and are not available from stock libraries of 3D model parts.

Heritage professionals bring expert knowledge to the project to facilitate the creation of accurate BIM models.



Images: 3D model for context at Dome. RMA.



Images: 3D model exports and in construction photos. Dome. RMA.

What can BIM bring to the Heritage Conservation field?

- ❖ Allow full study of proposed renovations and changes before final decisions are made.
- ❖ Assist in seeing how a built landscape will be affected by changes.
- ❖ Assist in maintaining buildings, by recording work that has been completed, programming schedules for maintenance.
- ❖ Program in schedules for maintenance.
- ❖ Aid in budgeting for repairs and maintenance.
- ❖ Program in material information.
- ❖ Allow wider public building experience as models can be viewed with free viewer software from remote locations.
- ❖ Sites like Google 3D warehouse of buildings in major cities allows review of cultural landscapes in present day settings and for past periods.

Tools such as Google Sketch-up are readily available for use to create 3D models, by a wider range of people.



Image: 3D model for heritage wall study.
RMA.

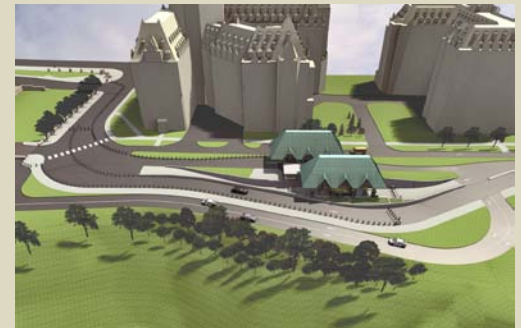


Image: 3D model for heritage context study.
RMA.

More Public Interaction:

As 3D models are created, become distributed, and available, the public will be able to interact with existing heritage buildings remotely. The technology is there to model existing city and site locations and also at different periods in time. If needed, one could use 3d printing technologies to print out buildings as models. (*Thingiverse*: <http://www.thingiverse.com/search?q=buildings&sa=Search>; *Solidoodle*: <http://www.solidoodle.com/>)



Photo: 3D model of Toronto - Beaches Landmark - Fire Station 227, created by atiemah <http://www.solidoodle.com/n.Thingiverse>.

Summary:

BIM is not only for the mainstream A&E, construction and property management, but also for the Heritage Conservation field. The use of BIM can help in the understanding and preservation of heritage both for the professional and the general public. Heritage professionals can be instrumental in preparing accurate BIM models when dealing with heritage buildings and cultural landscapes.



Photo: 3D model US capital, image downloaded from Google Earth, converted in Sketchup and printed using made Solidoodle 3D printer. *Solidoodle.com*.